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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/532,649	10/12/2005	Bin Liu	3248-6977US (R5/1145 PK/r	4382

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EXAMINER	
HEINCER, LIAM J	

ART UNIT	PAPER NUMBER
1796	

NOTIFICATION DATE	DELIVERY MODE
06/19/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

USPTOMail@traskbritt.com

Office Action Summary	Application No.	Applicant(s)	
	10/532,649	LIU, BIN	
	Examiner	Art Unit	
	Liam J. Heincer	1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 April 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21,32-42,47-52 and 60-65* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21,32-42,47-52 and 60-65* is/are rejected.

7)☒ Claim(s) *32-42,47-52,64 and 65* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/2005*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claims 47-52 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 47 provides a definition for A, B, E and F that does not fall within the scope defined by claim 1 from which it depends. Claim 47 defines one of A, B, E, and F as being a tetravalent nitrogen group, which is not one of the possible groups defined in claim 1. For the purpose of further examination, claim 47 is being interpreted as being an independent claim with the scope of A, B, E, and F being as defined in claim 47.

Claims 32-42, 64, and 65 are objected to because of the following informalities: Claim 32 recites the limitation "providing a conjugated cationic polymer" of a claimed formula. However, the formula disclosed does not contain a cation, and the polymer only becomes cationic following the quaternization step that follows. Therefore the claim should read "providing a conjugated polymer". Appropriate correction is required. It should be noted that all references to the conjugated cationic polymer in the dependent claims are being interpreted as referring the polymer before quaternization.

Claim 64 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. As addressed below in the section regarding 112 rejections, claim 64 is considered to provide no additional process step, but rather to describe an inherent property of the step of claim 60 from which it depends. Therefore the scope of the two claims is identical.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-21, 32-42, 47-53, and 60-65 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Considering Claims 1-21 and 47-53: Claim 1 defines C and D as possibly being hydrogen. However, in the formula of claim 1, C and D are divalent. Therefore C and D could not be hydrogen, as hydrogen can only bond to one atom. For the purpose of further examination, C and D are being considered to be selected from the group of O, S, CO, COO, CRR', NR' and SiR'R".

Considering Claims 32-42 and 60-65: Claim 32 defines C and D as possibly being hydrogen. However, in the formula of claim 1, C and D are divalent. Therefore C and D

could not be hydrogen, as hydrogen can only bond to one atom. For the purpose of further examination, C and D are being considered to be selected from the group of O, S, CO, COO, CRR', NR' and SiR'R".

Considering Claim 2: Claim 2 claims a homopolymer made with the polymer of claim 1. However, claim 1 as amended must contain two different repeat units (x and y must be at least 1). Therefore by definition claim 1 is a copolymer rather than a homopolymer. The polymer cannot be both a homopolymer and a copolymer as claimed in claim 2.

Considering Claims 60-63: Claim 60 depends from claim 32. However, Claim 60 appears to provide a completely distinct method of making a conjugated cationic polymer than claim 32. Claim 60 provides a method of polymerizing quaternized monomers, while claim 32 provides a method of quaternizing a fully formed polymer. Since the method of claim 60 depends from claim 32 it is not clear if the method of claim 32 further comprises the steps of claim 60 or if claim 60 is a distinct process that should be treated as an independent claim. For the purpose of further examination claim 60 is being treated as an independent claim.

Additionally, Claim 60 recites the limitation "quaternizing terminal amino groups" in line 4. There is insufficient antecedent basis for this limitation in the claim. For the purpose of further examination the claim is being interpreted as "providing monomer precursors comprising terminal amino groups" in line 3.

Considering Claims 62, 63, and 65: The term "desired solubility" in claims 62, 63, and 65 is vague and indefinite. Therefore the scope of the claim is indefinite.

Considering Claim 64: Claim 64 recites the limitation "wherein quaternizing terminal amino groups of the conjugated cationic polymer comprises increasing the solubility of the conjugated cationic polymer in a solvent". It is unclear if this step is inherent when practicing the quaternizing step or if it a separate step preformed at the same time. If it is a separate step there has been no guidance provided in the claim or original specification as to how to perform this step. Therefore the claim is being interpreted as having the increase in solubility being inherent when performing the quaternization step.

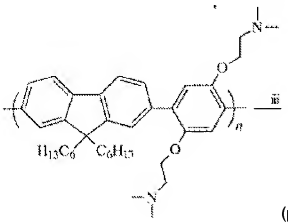
Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3-5, and 7-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994) and Huang et al. (US 2002/0013451).

Considering Claims 1, 4, 5, 7-15, and 19: Liu et al. teaches a polymer of the formula



(page 551).

Liu et al. does not teach the fluorene as having alkyl chains comprising a heteroatom. However, Huang et al. teaches a substituted fluorene-phenylene copolymer with alkoxy substituents (¶0026). Liu et al. and Huang et al. are combinable as they are concerned with the same field of endeavor, namely fluorene-phenylene copolymers. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the alkoxy substituents of Huang et al. in the place of the alkyl substituents of Liu et al., and the motivation to do so would have been, as Huang et al. suggests, to control the solubility and electronic tenability of the polymer (¶0026).

Liu et al. does not teach the phenylene side chain as having both a heteroatom and an aromatic group. However, Rau et al. teaches using a phenoxy group in the side chain of a functionalized polyphenylene (page 4). Liu et al. and Rau et al. are combinable as they are concerned with the same field of endeavor, namely polyphenylenes with functionalized side chains. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the phenoxy groups

of Rau et al. in the polymer of Liu et al., and the motivation to do so would have been, as Rau et al. suggests, to improve the solubility of the polymer (page 3).

Considering Claims 3, 20, and 21: Liu et al. does not teach the polymer as being random. However, due to the close structural similarity between the disclosed polymer and the claimed polymer a person having ordinary skill in the art at the time of invention would have expected them to possess similar properties. Thus the claimed structure is prima facie obvious in view of the prior art structure. See MPEP § 2144.09.

Considering Claim 16: Liu et al. teaches a weight average molecular weight of 47000 and a polydisperisty of 1.61 (page 551). Based on a molecular weight of ~570 per repeat unit there would be approximately 51 repeat units per polymer. Since this is the average number of units, there would implicitly be polymers with less than this number of units/1 to 50.

Considering Claim 17: Liu et al. is silent as to an endcapping reaction. Therefore one could reasonably assume that the end units comprise on of each monomer type/an aryl moeity containing a halogen and a borante radical.

Considering Claim 18: Liu et al. does not teach endcapping. However, Huang et al. teaches endcapping a fluorene-phenylene polymer with aryl groups (¶0030). It would have been obvious to a person having ordinary skill in the art at the time of invention to have endcapped the polymer of Liu et al. with the aryl groups of Huang et al., and the motivation to do so would have been, as Huang et al. suggests, to end the reaction at the desired molecular weight (¶0030).

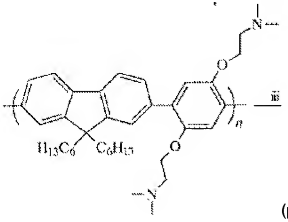
Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994) and Huang et al. (US 2002/0013451) as applied to claim 1 above, and further in view of Woo et al. (WO 99/54385).

Considering Claim 6: Liu et al., Rau et al., and Huang et al. collectively teach the polymer of claim 1 as shown above.

Liu et al. does not teach the fluorene as being additionally substituted. However, Woo et al. teaches including alkoxy groups with 1 to 4 carbon atoms on a fluorene polymer (3:10-14). Liu et al. and Woo et al. are combinable as they are concerned with the same field of endeavor, namely fluorene polymers. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the alkoxy groups of Woo et al. in the polymer of Liu et al. and the motivation to do so would have been, as Woo et al. suggests, it is equivalent to the hydrogen atoms presented in Liu et al. (3:10-14).

Claims 32-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994) and Huang et al. (US 2002/0013451).

Considering Claim 32: Liu et al. teaches providing a polymer of the formula



(page 551); and quaternizing the terminal amino groups (page 551). : Liu et al. also teaches a weight average molecular weight of 47000 and a polydisperisty of 1.61 (page 551). Based on a molecular weight of ~570 per repeat unit there would be approximately 51 repeat units per polymer. Additionally, Liu et al. is silent as to an endcapping reaction. Therefore one could reasonably assume that the end units comprise on of each monomer type/an aryl moeity containing a halogen and a borante radical.

Liu et al. does not teach the fluorene as having alkyl chains comprising a heteroatom. However, Huang et al. teaches a substituted fluorene-phenylene copolymer with alkoxy substituents (¶0026). Liu et al. and Huang et al. are combinable as they are concerned with the same field of endeavor, namely fluorene-phenylene copolymers. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the alkoxy substituents of Huang et al. in the place of the alkyl substituents of Liu et al., and the motivation to do so would have been, as Huang et al. suggests, to control the solubility and electronic tenability of the polymer (¶0026).

Liu et al. does not teach the phenylene side chain as having both a heteroatom and an aromatic group. However, Rau et al. teaches using a phenoxy group in the side chain of a functionalized polyphenylene (page 4). Liu et al. and Rau et al. are combinable as they are concerned with the same field of endeavor, namely polyphenylenes with functionalized side chains. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the phenoxy groups of Rau et al. in the polymer of Liu et al., and the motivation to do so would have been, as Rau et al. suggests, to improve the solubility of the polymer (page 3).

Considering Claim 33: Liu et al. teaches the highest degree of quaternization obtained as being 80% (page 552).

Considering Claims 34-39: Liu et al. teaches stirring the polymer with bromoethane in DMSO and THF in a ratio of 1:4 at about 50 °C for 3 days/about 1 or 5 days (page 551).

Claims 40-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994) and Huang et al. (US 2002/0013451) as applied to claim 36 above, and further in view of Ho et al. (WO 00/60612).

Considering Claims 40-42: Liu et al., Rau et al., and Huang et al. collectively teach the method of claim 36 as shown above. Additionally, during the conversion treatment of the polymer, at least a portion of the DMSO and THF would inherently evaporate.

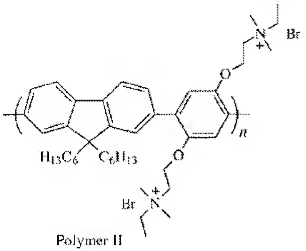
Liu et al. does not teach the polymer as being precipitated and washed. However, Ho et al. teaches precipitating a fluorene polymer in acetone, centrifuging the

precipitate and washing the polymer with chloroform (page 20). Liu et al. and Ho et al. are combinable as they are concerned with the same field of endeavor, namely fluorene copolymers. It would have been obvious to a person having ordinary skill in the art at the time of invention to have sued the purification steps of Ho et al. in the process of Liu et al., and the motivation to do so would have been, as Ho et al. suggests, to purify the polymer (page 20).

Liu et al. does not teach drying the polymer. However, Huang et al. teaches drying a fluorene polymer (¶0030). It would have been obvious to a person having ordinary skill in the art at the time of invention to have dried the polymer of Liu et al. as in Huang et al., and the motivation to do so would have been, as Huang et al. suggests, to remove residual solvent from the polymer (¶0030).

Claim 47-53, 64, and 65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552) in view of Rau et al. (Acta Polymer, 45, 3-13, 1994) and Huang et al. (US 2002/0013451).

Considering Claims 47, 49, 50-52, and 64: Liu et al. teaches a polymer of the formula



Polymer II (page 551).

Liu et al. does not teach the fluorene as having alkyl chains comprising a heteroatom. However, Huang et al. teaches a substituted fluorene-phenylene copolymer with alkoxy substituents (¶0026). Liu et al. and Huang et al. are combinable as they are concerned with the same field of endeavor, namely fluorene-phenylene copolymers. It would have been obvious to a person having ordinary skill in the art at the time of invention to have used the alkoxy substituents of Huang et al. in the place of the alkyl substituents of Liu et al., and the motivation to do so would have been, as Huang et al. suggests, to control the solubility and electronic tenability of the polymer (¶0026).

Liu et al. does not teach the phenylene side chain as having both a heteroatom and an aromatic group. However, Rau et al. teaches using a phenoxy group in the side chain of a functionalized polyphenylene (page 4). Liu et al. and Rau et al. are combinable as they are concerned with the same field of endeavor, namely polyphenylenes with functionalized side chains. It would have been obvious to a person

having ordinary skill in the art at the time of invention to have used the phenoxy groups of Rau et al. in the polymer of Liu et al., and the motivation to do so would have been, as Rau et al. suggests, to improve the solubility of the polymer (page 3).

Considering Claim 48: Liu et al. does not teach the one of the R groups as being hydrogen. However, due to the close structural similarity between the disclosed polymer and the claimed polymer a person having ordinary skill in the art at the time of invention would have expected them to possess similar properties. Thus the claimed structure is prima facie obvious in view of the prior art structure. See MPEP § 2144.09.

Considering Claim 53: Liu et al. teaches the highest degree of quaternization obtained as being 80% (page 552).

Liu et al. does not teach the quaternization degree as being from 30 to 60%. However, it is well known in the art to optimize result effective variables such as quaternization degree. It would have been obvious to a person having ordinary skill in the art at the time of invention to have optimized the degree of quaternization through routine optimization, and the motivation to do so would have been, as Liu et al. suggests, to control the water solubility of the polymer (page 551). See MPEP § 2144.05.

Considering Claim 65: Liu et al. is concerned with the solubility of the polymer (page 551). Therefore a person having ordinary skill in the art at the time of invention would necessarily calculate the desired solubility and tailor the production to give this solubility.

Claims 60-63 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (Chem Commun, 2000, 551-552).

Considering Claims 60 and 61: Liu et al. teaches a method comprising providing monomers with terminal amino groups; synthesizing a conjugated polymer through Suzuki coupling; and quaternizing the terminal amino groups (page 551). While Liu et al. does not explicitly disclose quaternizing the terminal amino groups prior to the polymerization, Liu et al. does discuss the advantages of the post-polymerization versus pre-polymerization quaternization (page 551). Therefore, Liu et al. implicitly discloses a method of quaternizing the amino groups prior to polymerization.

Considering Claims 62 and 63: Liu et al. is concerned with the solubility of the polymer (page 551). Therefore a person having ordinary skill in the art at the time of invention would necessarily calculate the desired solubility and tailor the production to give this solubility.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. See PTO Form 892.

Double Patenting

Applicant is advised that should claim 62 be found allowable, claim 63 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing

one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Applicant is advised that should claim 32 be found allowable, claim 64 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Liam J. Heincer whose telephone number is 571-270-3297. The examiner can normally be reached on Monday thru Friday 7:30 to 5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Eashoo can be reached on 571-272-1197. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MARK EASHOO/
Supervisory Patent Examiner, Art Unit 1796
13-Jun-08

LJH
June 6, 2008